Air Toxics Research Strategy And Multi-Year Plan SAB Review

July 23-24, 2003

Chon Shoaf, PhD

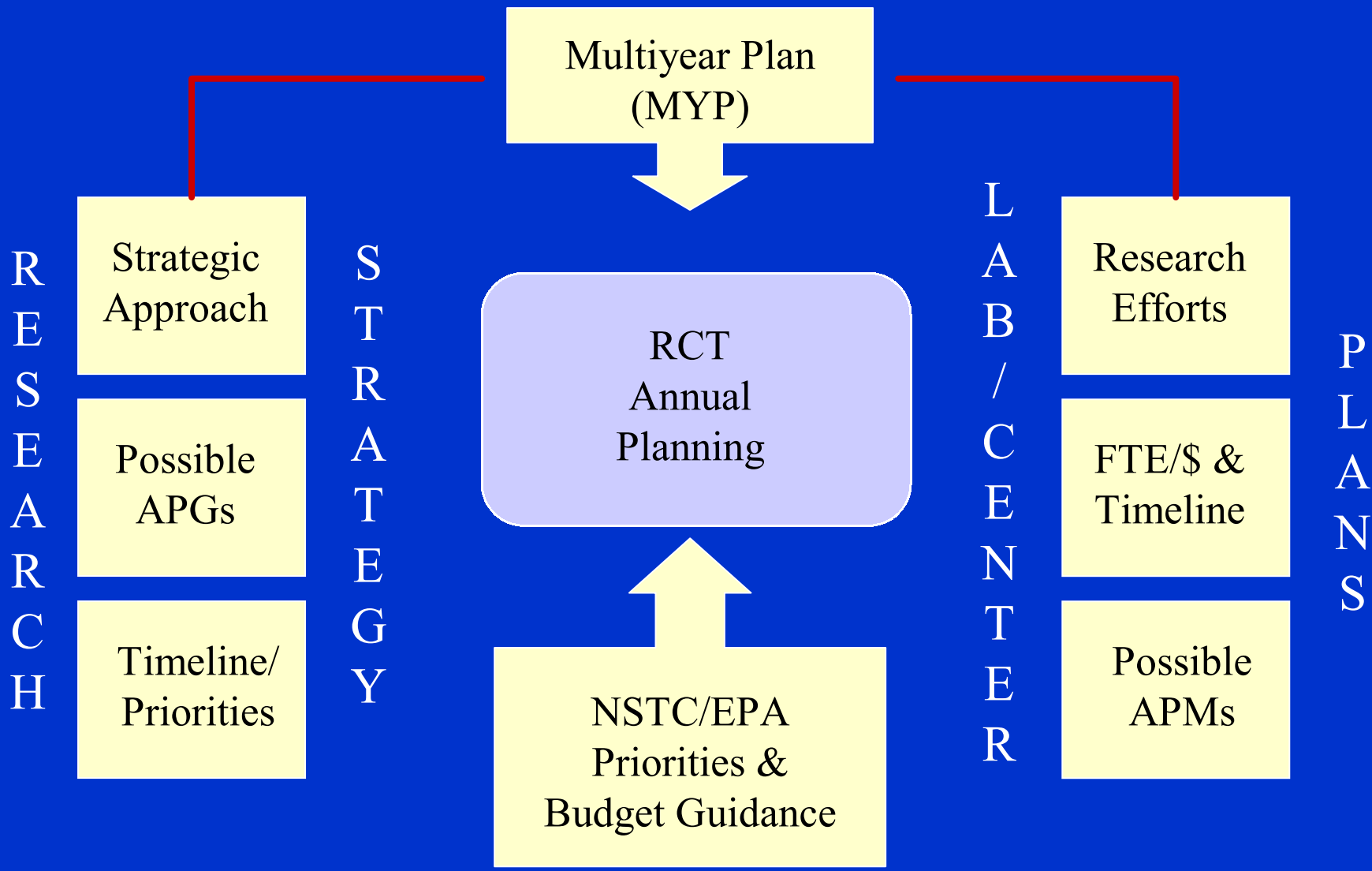
Assistant Center Director

Presentation Overview

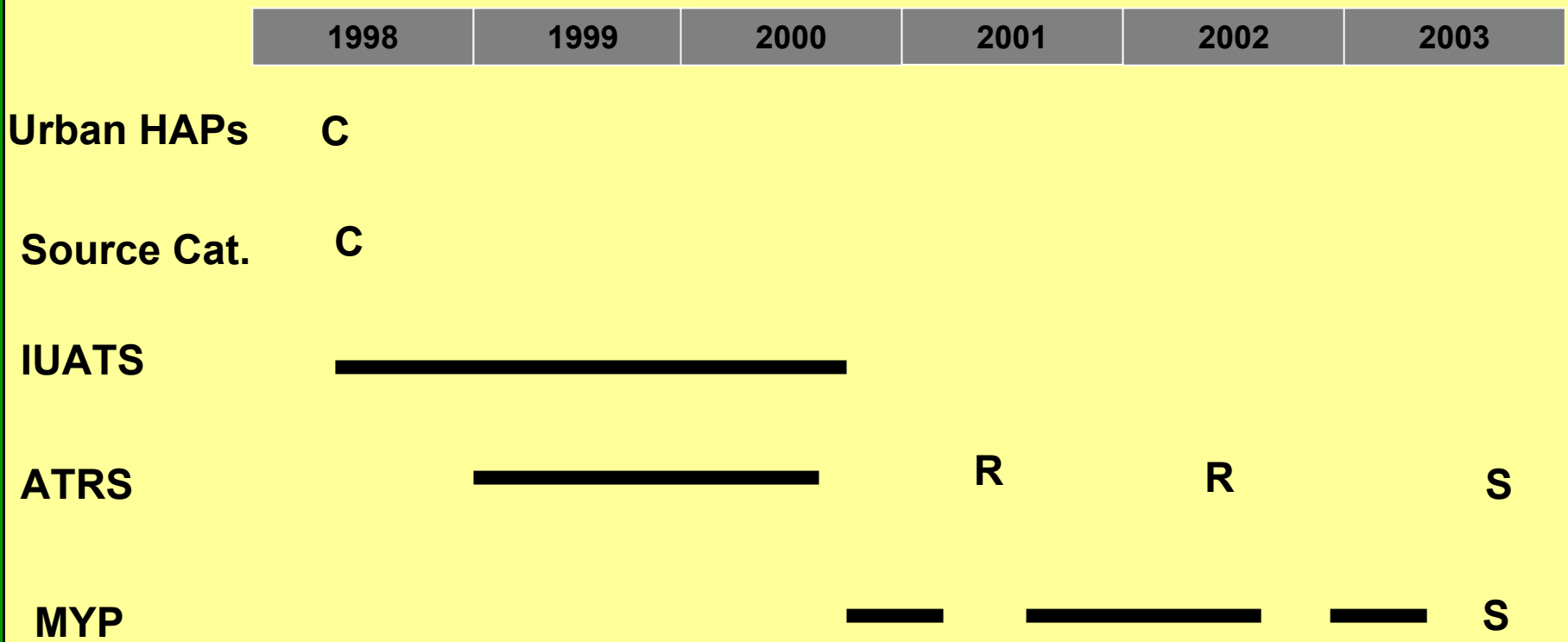
- What is the history of the ORD's Air Toxics Research Strategy and Multi-Year plan development?
- What are ORD's air toxics resources?
- Content of the Air Toxics Research Strategy
- Content of the Air Toxics Multi-Year Plan

HISTORY

Annual Research Planning

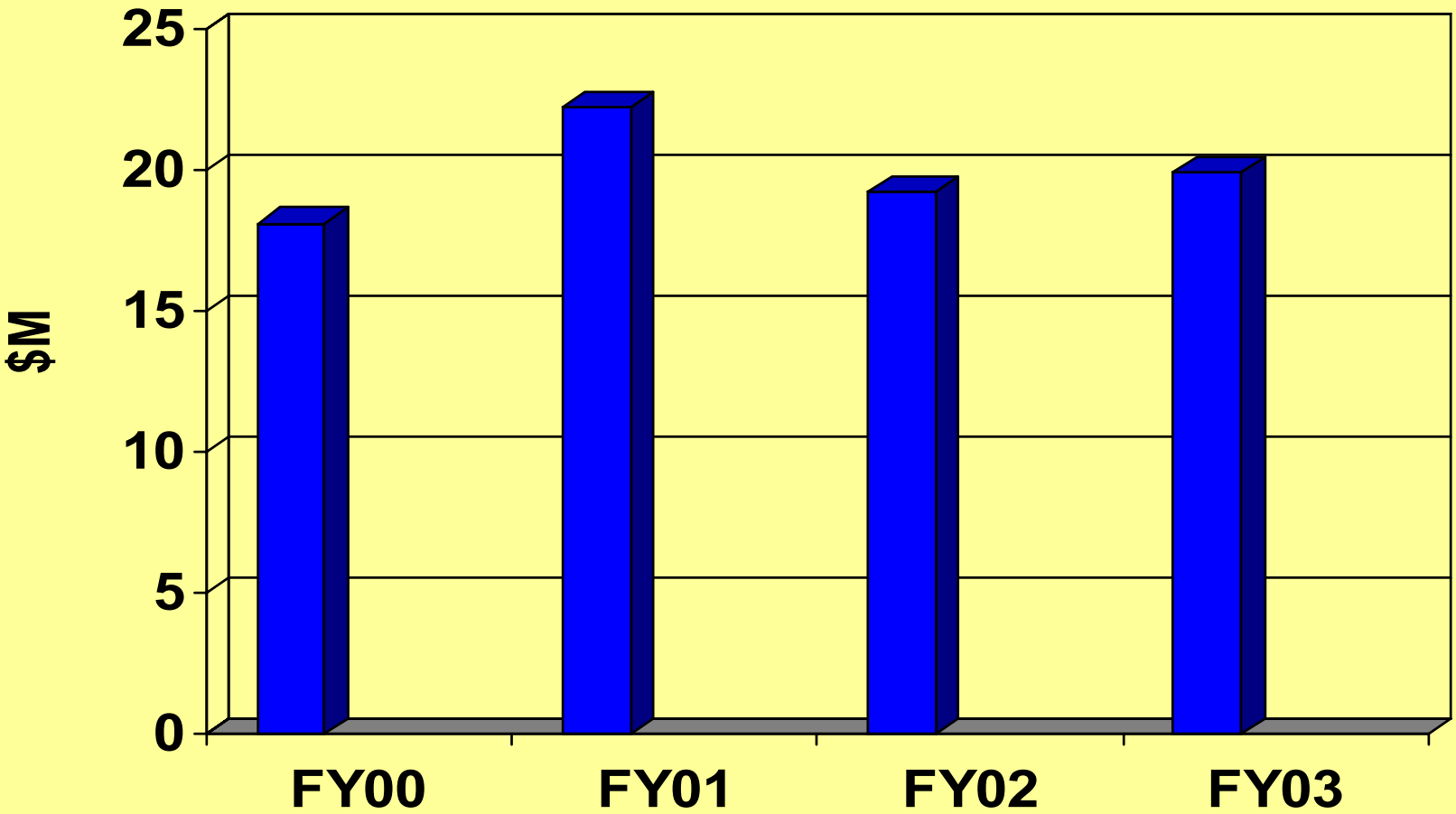


History of ATRS and MYP Development

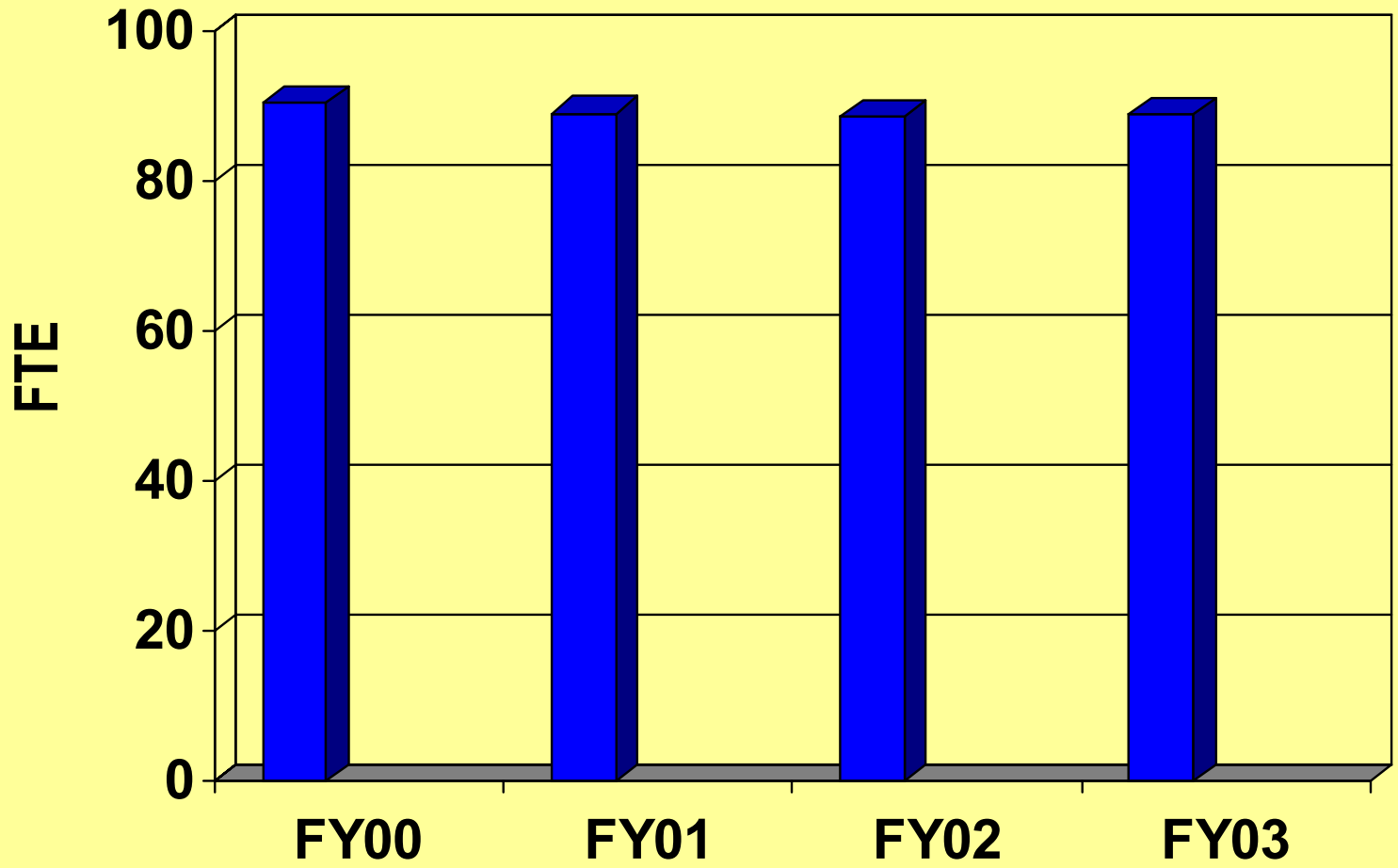


RESOURCES

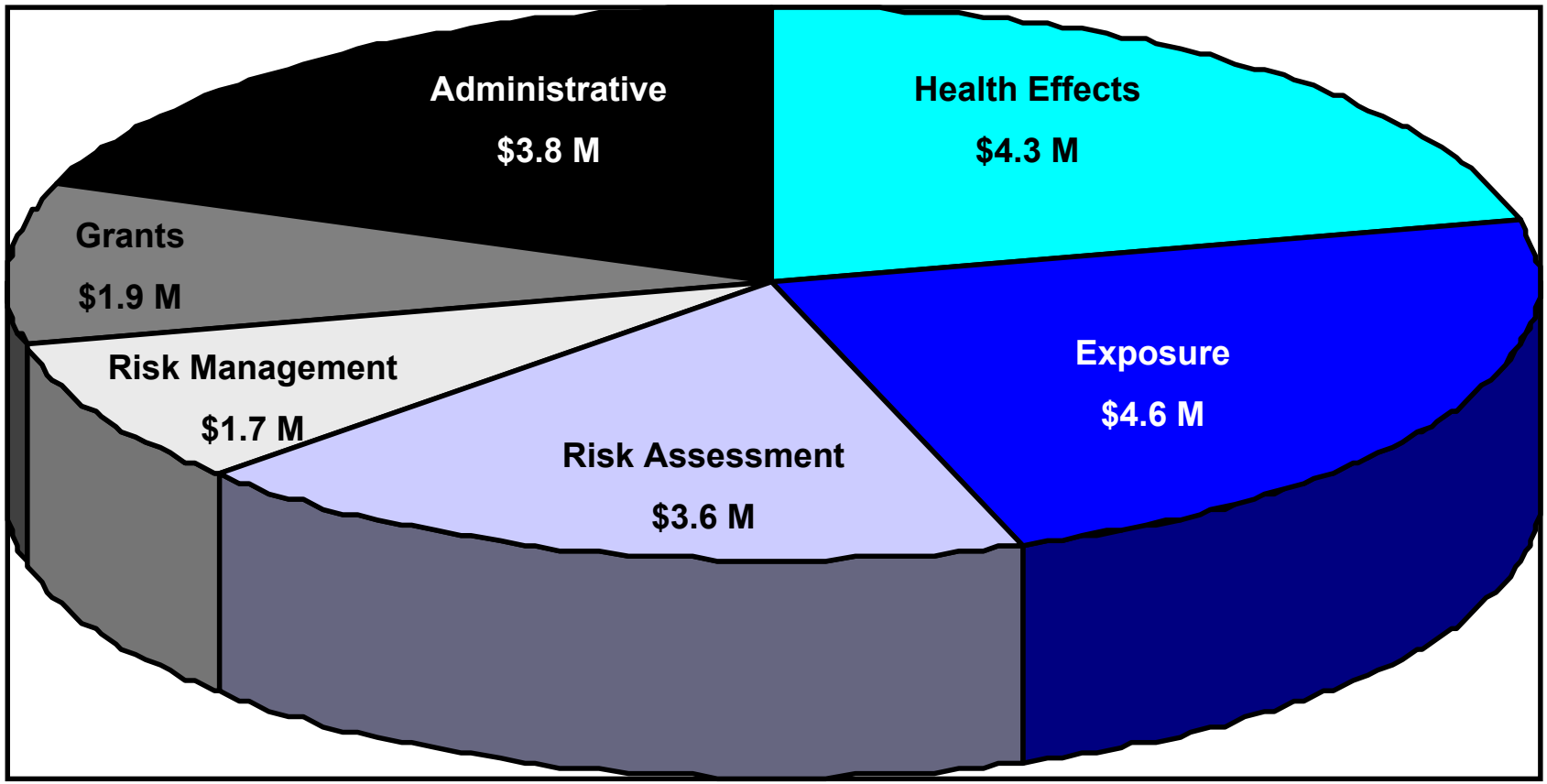
Air Toxics Budget FY00-FY03



Air Toxics FTE FY00-FY03



FY03 Air Toxics Budget



AIR TOXICS RESEARCH STRATEGY

Chapter 1: Clean Air Act Amendments, 1990 and Air Toxics Program

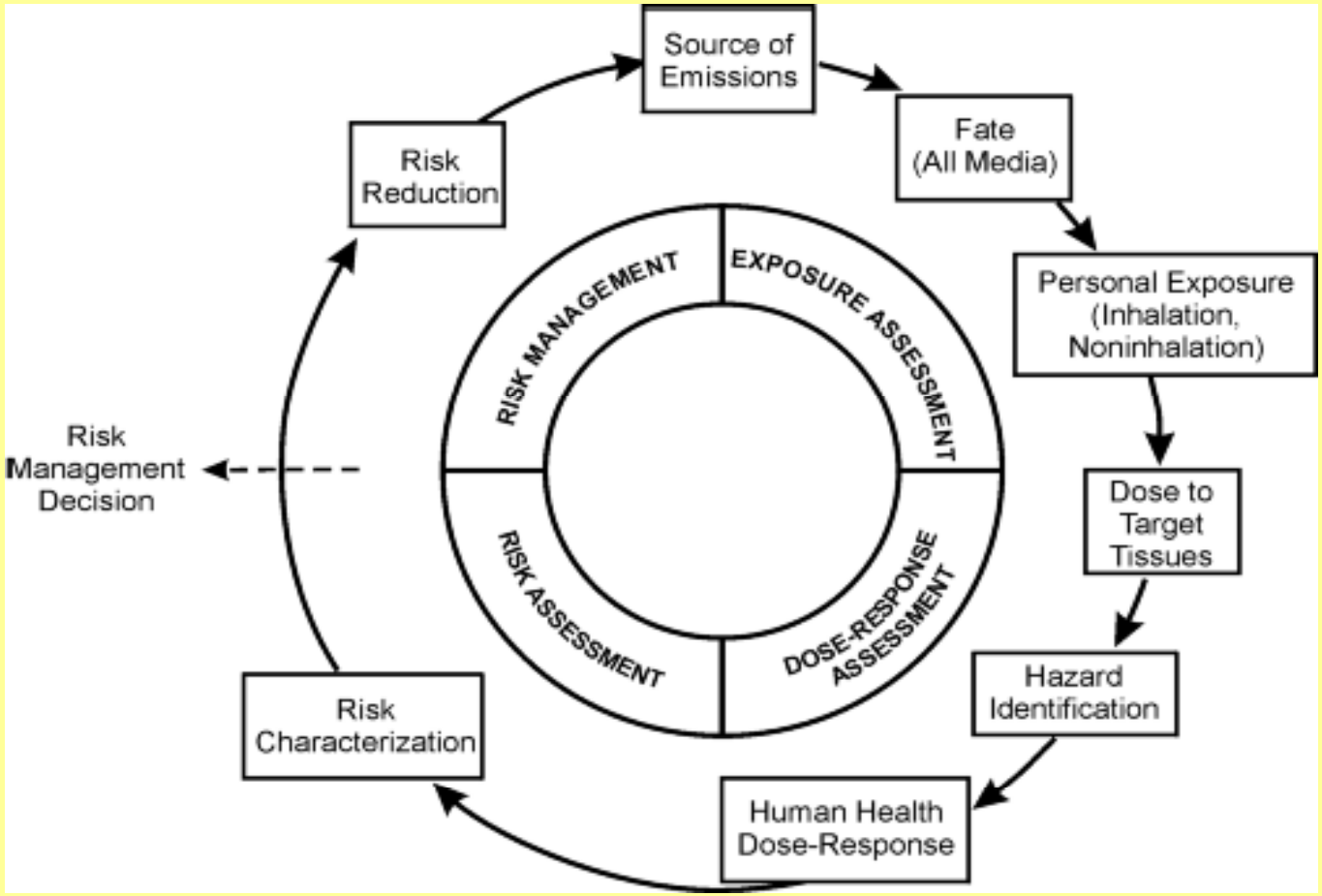
- CAAA, 1990
  - 112(b) -- list of 188 HAPs (air toxics)
  - 112(c) -- regulate 90% of area source emissions
  - 112(d) – set emission standards (MACT)
  - 112(f) -- measure success through residual risk
  - 112(k) -- 75% reduction in incidence of carcinogenesis
  - 112(k) -- 30 HAPs greatest threat to public health
  - 202(l) -- regulate motor vehicle air toxics

… and Air Toxics Program

- National Air Toxics Assessment (NATA)
  - emissions inventory
  - monitoring and exposure modeling
  - risk assessment
  - research
- National, regional, community-based initiatives
  - Urban Air Toxics Strategy
  - Cleveland and other community based projects
- Source-specific and sector-based standards
  - MACT, residual risk, area, mobile source
  - Combustion and utility standards
- Education and Outreach

Chapter 2: Air Toxics Research Strategy Process

Risk Assessment/Risk Management Framework



HAP Focus and Prioritization

- **Grouping (Table 4)**
  - Aldehydes and Ketones/Acylating Agents
  - Metals/Minerals
  - Polycyclic Organic Matter (POM)/Hydrocarbons
  - Halides
- **Regulatory Needs**
  - Urban Air Toxics (Table 5)
  - Mobile Source Air Toxics (Table 6)
  - Indoor Air Toxics (Table 7)
  - Stationary Source Air Toxics (Table 8)
- **Crosswalk Groups and Regulatory Needs (Table 9)**

Crosswalk of Groups and Priority Program Air Toxics

Aldehydes/ Ketones	Metals	POM/ Hydrocarbons	Halides
Acetaldehyde (4)	Arsenic Cmpd*(4)	Benzene*(4)	Chloroform (3)
Formaldehyde*(4)	Chromium Cmpd*(3)	1,3-Butadiene (3)	Dioxin (3)
Acrolein*(3)	Lead (3)	POM/PAH*(3)	PERC (3)
Methyl Ethyl Ketone	Manganese Cmpd*(3)	Hexane (2)	TCE (3)
Methyl Isobutyl Ketone	Mercury Cmpd (3)	Naphthalene (2)	Carbon Tet.*(2)
	Nickel Cmpd (3)	Styrene (2)	EDB (2)
	Cadmium Cmpd (2)	Toluene (2)	Methyl Cl (2)
	Antimony	Xylene (2)	$MeCl_2$ (2)
	Beryllium Cmpd	Cumene	Chlorodane
	Cobalt	Dibenzofurans	Chlorine
		Diesel Exhaust	1,4-Dichlorobenz.

Strategic Principles

- Group air toxics initially based on physicochemical properties to assist SAR
- Greatest risks to people and the environment
- Reduce uncertainty in risk assessment and improve cost effectiveness of risk management
- Foster multidisciplinary research
- Achieve appropriate balance of near-term and long-term research

Chapter 3 Example: Priority Research for POMs

- By key question
- References research needs

Chapter 4, Implementation

- Multi-Year Plan
- Steering committee (Implementation Plan)
- Scientist-to-scientist meetings
- Expected outcomes
  - Information on groups
  - National scale assessments
  - Residual risk

AIR TOXICS MULTI-YEAR PLAN

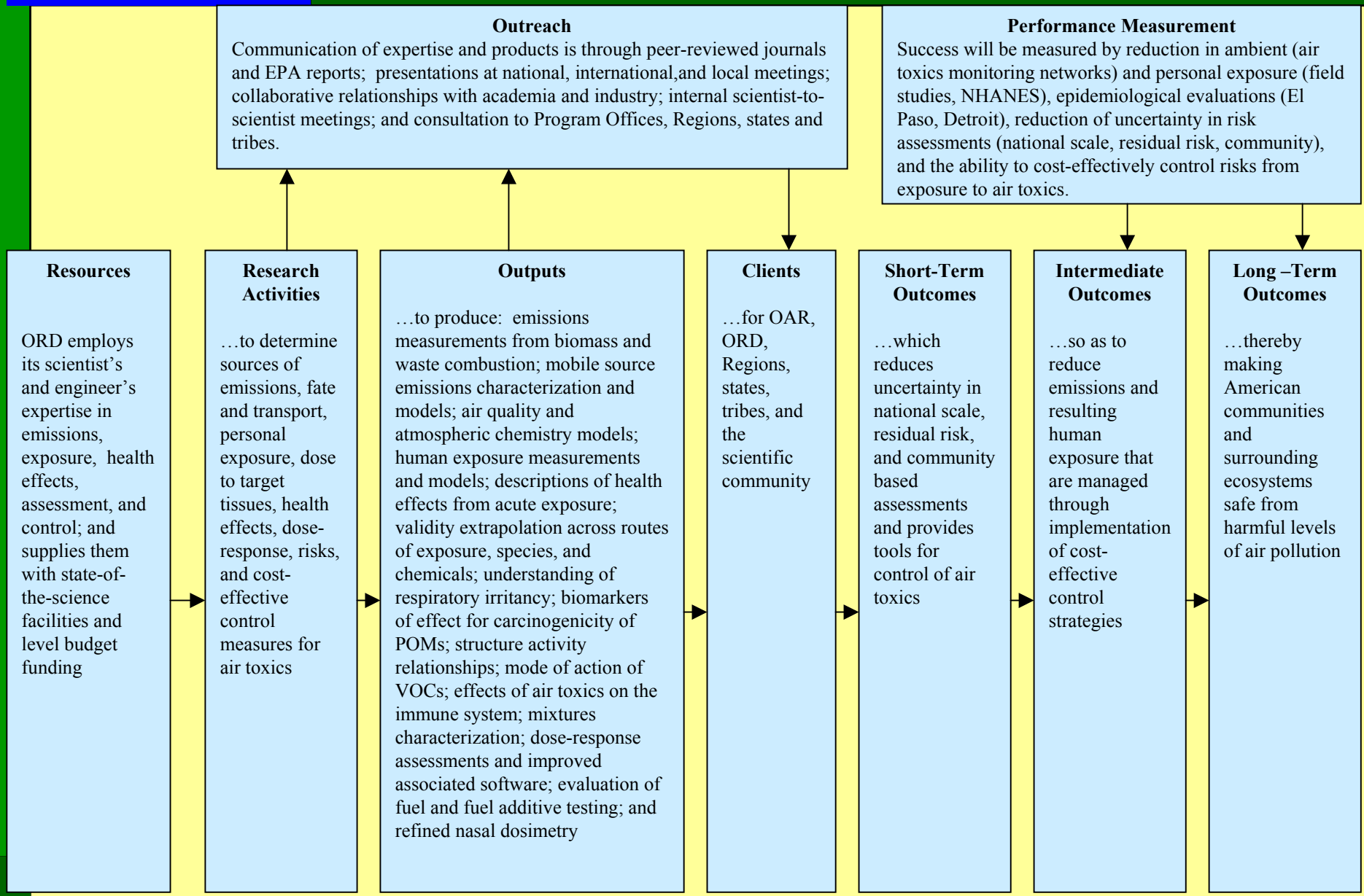
Overview of Multi-Year Plan

- **Relationship to the Agency GPRA Goal**
  - **…American communities and surrounding ecosystems …safe from harmful levels of air pollution and radiation**
  - **188 outdoor and indoor air toxics; focused (see below)**
  - **Not eco; not radiation; not criteria pollutants**

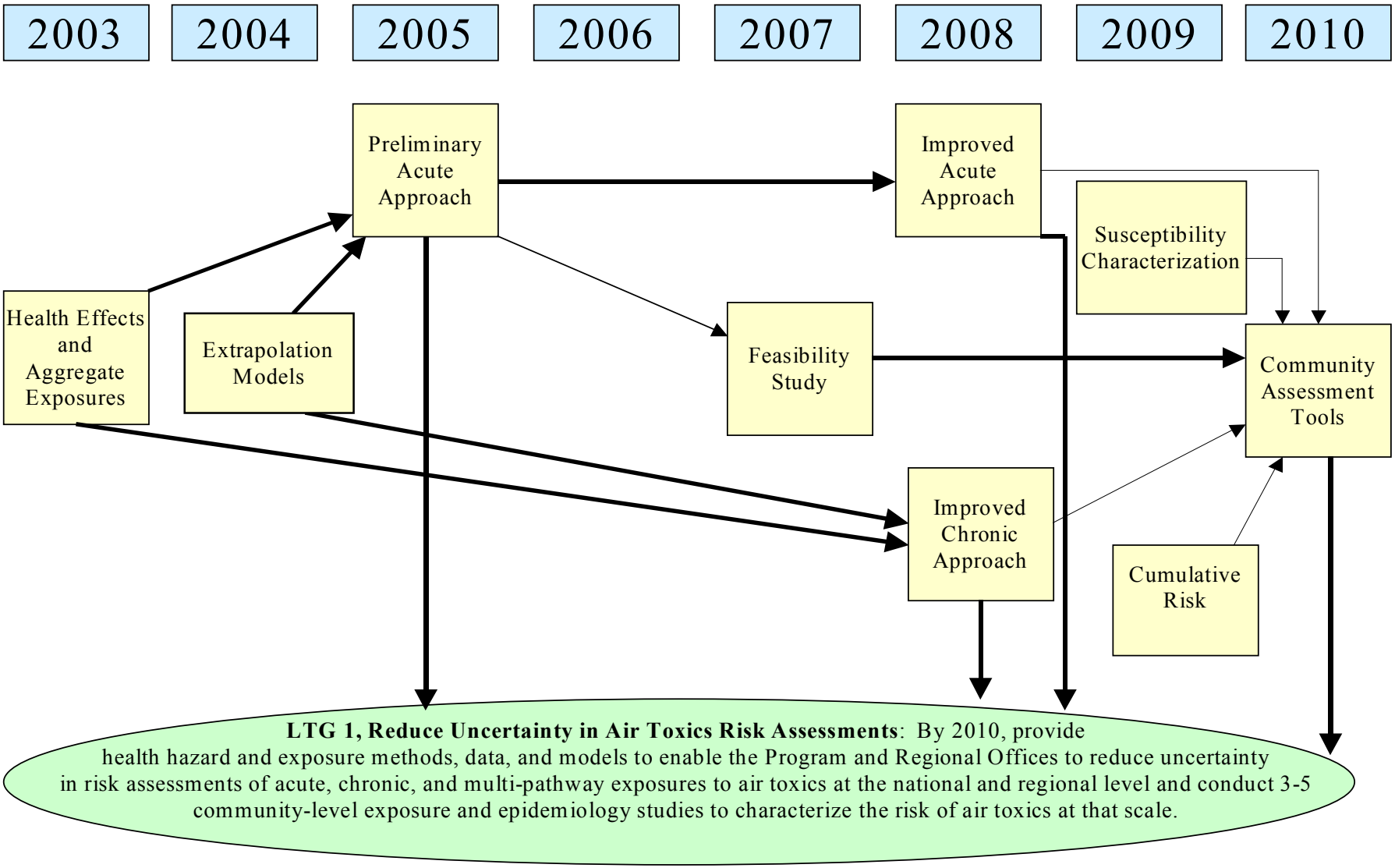
- **Relationship to Research Strategy**
  - **Seeks to focus research**
    - **Hazardous Air Pollutant (HAP) groups**
    - **Regulatory needs**
  - **Seeks to answer the same science questions**

EPA's Strategic Architecture

- Clean Air Goal 1 - …protect and improve the air so it is healthy to breathe and free of levels of pollutants that harm human health or the environment
  - Objective 1.1, Outdoor air – Through 2010…emissions will decline…and ambient air quality will improve…to protect public health and the environment
  - Objective 1.2, Indoor air – By 2008…healthier indoor air in homes, schools, and office buildings
  - Objective 1.5, Science/Research -- …conduct leading-edge research and develop better understanding and characterization of environmental outcomes under Goal 1



Air Toxics Logic Model



Critical Path for Long-Term Goal 1

Long-Term Goal 1

- Relationship to Agency's priorities and regulatory programs
  - Need for risk assessment of acute exposures
  - Need to improve chronic approach and extrapolation methods within HAP groups
  - Need for community based risk assessment

Major Research Activities (Acute Approach)

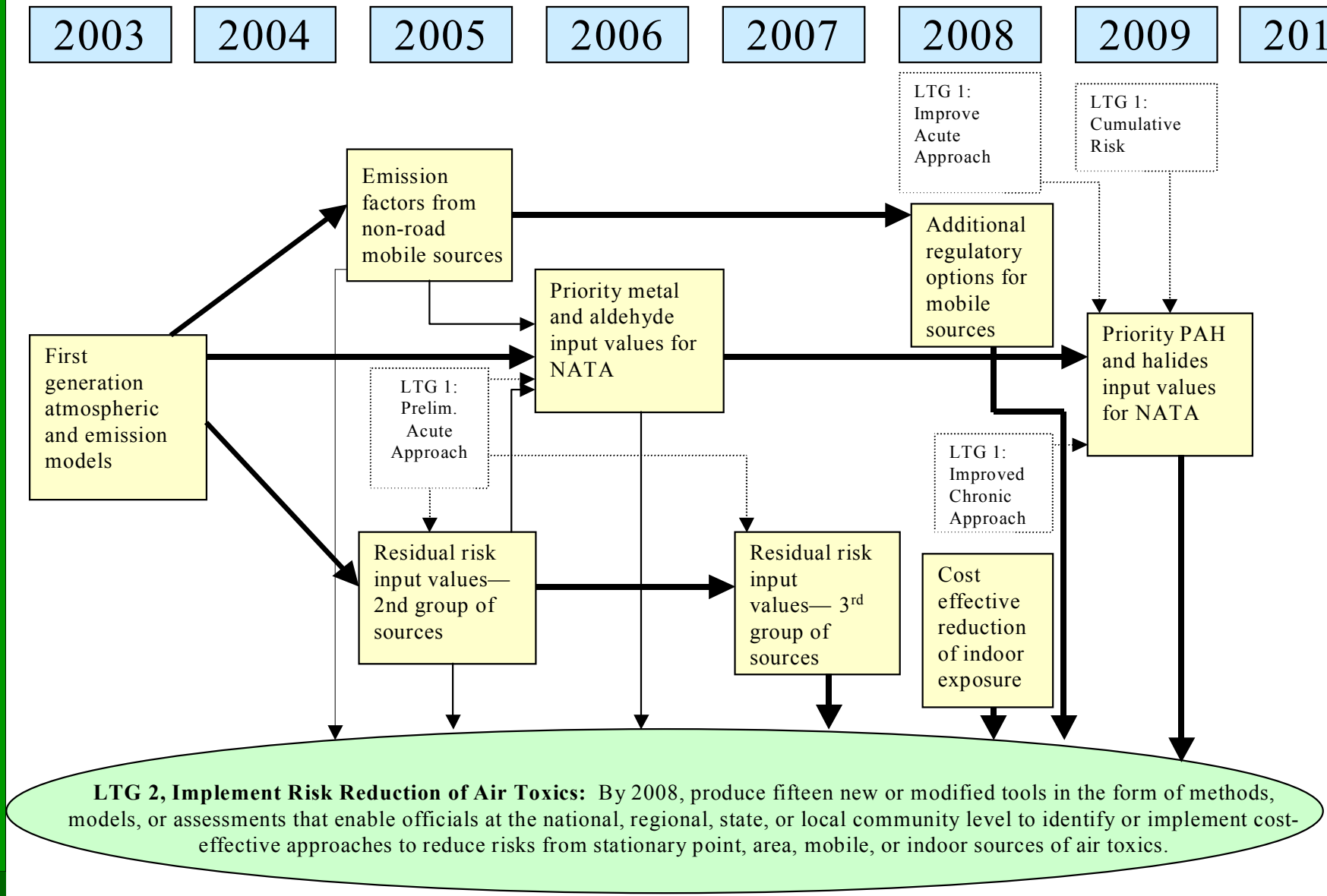
- FY03, 04
  - Extrapolation across routes and from animals to humans…
- FY05
  - Draft of revised Acute Reference Exposure (ARE) methodology
- FY06
  - Produce data on short term human exposures to air toxics
  - Summary report on internal dose metrics and acute VOC neurotoxicity
  - Acute Reference Exposure (ARE) assessments developed as special case studies for selected key HAP chemicals
- FY08
  - …extrapolation model of acute solvent behavioral effects
  - Update the SHEDS model with recent exposure studies and demonstrate its applicability for estimating acute exposures

Major Research Activities (Chronic Approach)

- FY04
  - Peer review methodology for analysis of nasal dosimetry and delivered dose to the lung for RfC values
- FY05/06/07
  - Develop and apply proteomics method to determine common mechanisms of injury in air toxics groups
- FY06/07/08
  - Benchmark Dose software revised to support saturable effects (FY06), continuous data (FY07), and epidemiological data (FY08)
- FY08
  - Revised inhalation methodology for Risk Assessment Forum review

Major Research Activities (Community Assessment Tools)

- FY05
  - Draft of revised Acute Reference Exposure (ARE) methodology complete for submission to peer review
- FY06
  - Demonstrate the use of exposure measurement and models
- FY07
  - Determine the health endpoints to quantify in epidemiological studies of the health effects of exposure to air toxics
- FY09
  - Develop … cumulative human exposure model…to estimate exposures to multiple chemicals via multiple pathways
- FY10
  - Conduct measurements and apply the SHEDS model to classify human exposures in community-based epidemiological studies



Critical Paths for Long-Term Goal 2

Long-Term Goal 2

- Relationship to Agency's priorities and regulatory programs
  - Supports mobile source air toxics reassessment
  - Supports residual risk assessments
  - Supports national scale assessments under NATA

- Logic behind sequence of APGs
  - Mobile source emissions → Exposure→Reassessment
  - 2nd group of residual risk assessments → 3rd group of residual risk assessments
  - 2nd National Scale Assessment → 3rd National Scale Assessment

Major Research Activities (Mobile Source Reassessment)

- FY04
  - Deliver to OTAQ … emissions data from small engines …needed to improve and update the National Emissions Inventory
  - Enhance current exposure models … to better address exposures related to mobile sources
- FY07
  - Complete an operational MEASURE model … improved spatial and temporal allocation of vehicle activity and emission factors
- FY08
  - Apply the SHEDS model to characterize the range of population exposure related to mobile sources…

Major Research Activities (Residual Risk)

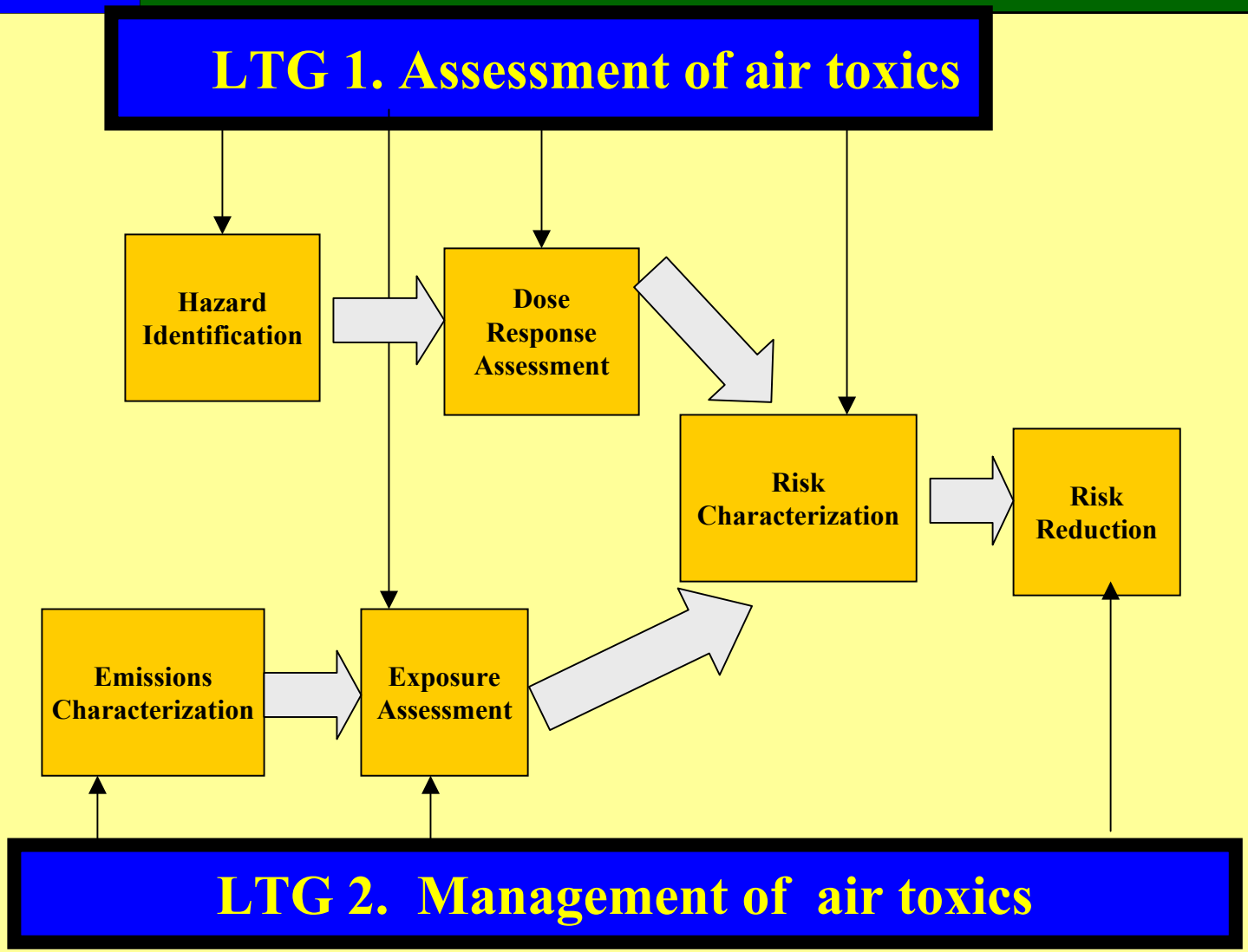
- **FY04,05,06,07**
  - **Develop for external peer review four dose-response assessment which support residual risk assessments…**
- **FY07**
  - **Provide … report on the most recently available exposure information and tools for … developing residual risk standards**

Major Research Activities (NATA)

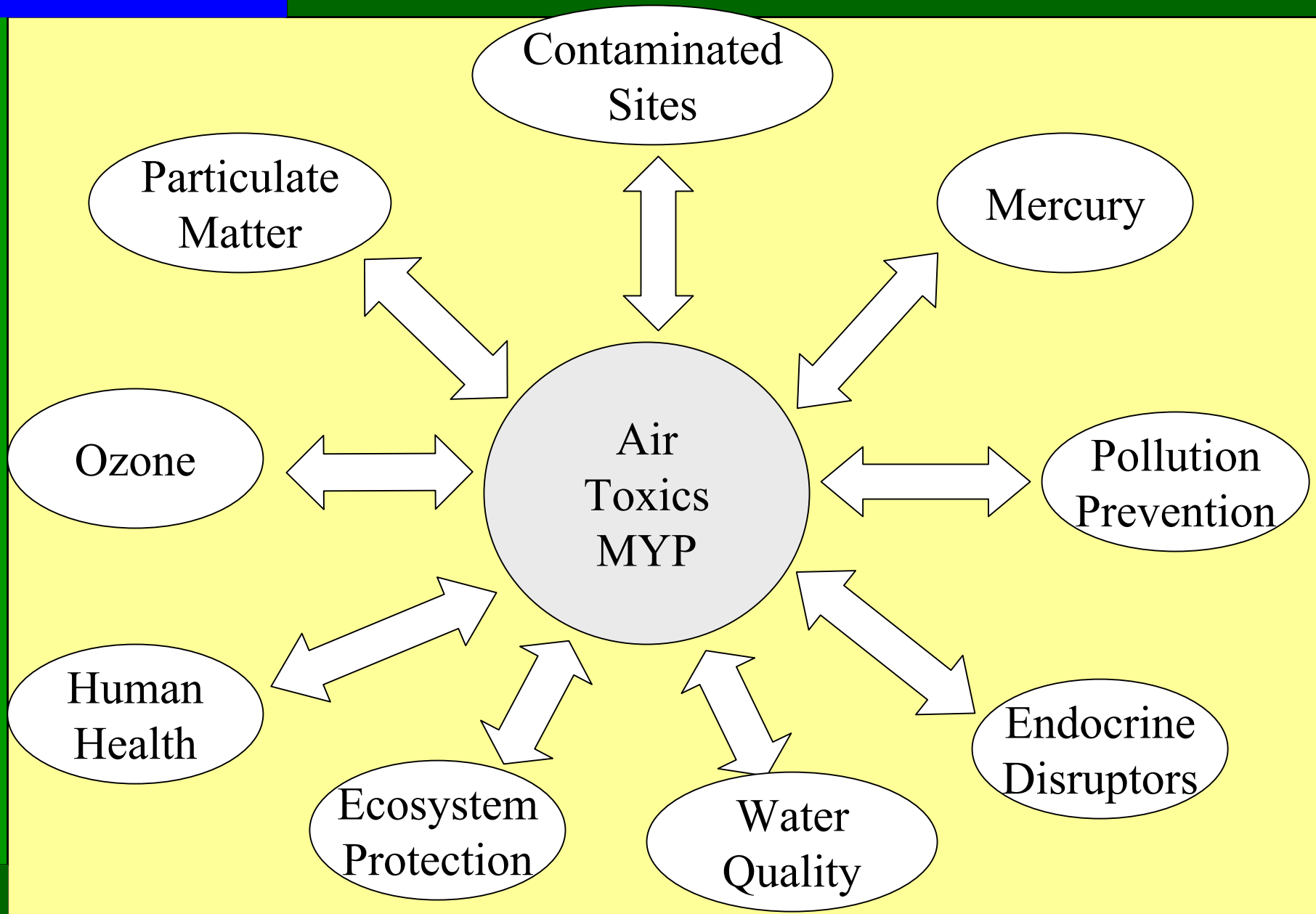
- FY06
  - Update CMAQ modeling system to include aldehydes and metals on the Urban Air Toxics list
  - Evaluate metal speciation of arsenic, nickel, and chromium in selected combustion systems
- FY07
  - Develop, evaluate, and field-test the Jet-REMPI technology for measurement of trace organics
- FY08
  - Update CMAQ modeling system to include halides and PAHs on the Urban Air Toxics list

Summary

- Emphasis
  - Acute assessment approach
  - Community assessment tools
  - Regulatory support
    - NATA
    - residual risk
    - mobile source reassessment
- Additional research needs
  - Analytical methods to measure ambient and personal exposure
  - Assessments of exposure in microenvironments
  - Epidemiological studies of community hotspots



Relationship of Long Term Goals to risk assessment/risk management paradigm



Influence of other MYPs on the Air Toxics MYP

Key Questions

1. What are the rates and characteristics of air toxic emissions from indoor, mobile, and stationary sources and how do these emissions change based on various operating conditions and other influences (e.g. mode of operation, building characteristics, process changes)?
2. What is the role of atmospheric transport, transformation, fate and chemistry in air toxics concentrations (including indoor, micro-scale, urban, terrestrial, and regional concentrations)?
3. What is the relationship of concentrations of air toxics (from outdoor and indoor sources) to personal exposure?
4. What are the health hazards and dose-response relationships associated with exposure to air toxics?
5. What improvements can be made to dose-response assessments to reduce uncertainty?
6. What health risks can be characterized quantitatively for people exposed to air toxics?
7. How can risk from air toxics be prevented and managed cost effectively?